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Supply Chain Development

Examining the logistics service offering in a medical device company: A Case Study

Master of Science Thesis in the Quality and Operations Management Programme

DANAR DARA MUSTAFA

MASTER'S THESIS E2016:022

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Department of Technology Management and Economics
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CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, 2017

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Cover: Illustrating the management of the supply chain as one integrated unit in order to make the cog wheel spinning.
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Gothenburg, January, 2017

Danar Dara Mustafa

ABSTRACT

The management of supply chains is getting more complex in terms of coordination and shifting of customer needs and requirements. Therefore organizations need to continuously improve in order to satisfy these needs and requirements. Mölnlycke Healthcare (the medical device company) design and supply products and solutions in a range of areas such as wound treatment, pressure ulcer, and surgery. The healthcare setting is complex and its supply chain characteristics differ from manufacturing setting. Healthcare supply chain focuses on patient safety with a high volume of transactions and high process variations. One solution to meet the complexity in today's supply chains is a supply chain which moves beyond the thinking of "one-size-fits-all" approach. The new approach is based on the trend of a differentiated supply chain strategy.

Supply Chain Differentiation starts with the customer, understanding the structure, behavior, and strategies of what the customer sees as value. This thesis is focusing on examining the logistics service offer between different customers and to identify its values. Understanding the customers' needs and what value is for the customer is critical in the segmentation journey. The researcher worked in the company's main office in Gothenburg together with company representatives in order to get a deeper insight into supply chain processes.

The researcher collected data during two phases and combined several data collection methods. The findings from contracts, internal documents and interviews showed how the different values differed between the different customer segments. The conclusion is that today the customers have a variety of different logistics needs and requirements. Taking a step further and combining this finding with statistical data, differences between customers in terms of the amount of order, demand variability, and product varieties was identified. This finding concludes the need to match the right supply chain strategy for different customers in order satisfy all customers and be more efficient. The recommendations for the organization are to have differentiated supply strategy matching different customer needs and requirements. Further, providing a standard logistics offer matching the different strategies can reduce complexity and improve efficiency. The final recommendation is to continue to improve the supply chain together with stakeholders to ensure the mission of patient safety. In the last part of the thesis, both recommendation and suggestions for future work are presented.

Keywords:

Supply Chain Development; Supply Chain Strategy; Supply Chain Management; Supply Chain Differentiation; Agile Supply Chain Strategy; Lean Supply Chain Strategy; Healthcare Logistics; Logistics Service Offering

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1. INTRODUCTION

1.1 Background

Mölnlycke Healthcare is one of the world-leading medical product and solutions company. The company design and supply products and solutions in a range of areas such as wound treatment, pressure ulcer, and surgery. Today, 7500 employees reaching over 90 countries are working towards the mission to “outstanding solutions for safe, efficient surgical procedures and gentle, effective wound care”. The headquarters is located in Gothenburg, Sweden.

Today, Mölnlycke healthcare has 15 manufacturing sites and sales through distributors in 63 countries. The management of the supply chain is getting more complex in terms of coordination and efficiency and requires continuous improvements efforts to stay competitive and satisfying the customer’s needs.

In 1974, Wickham Skinner wrote the “The Focused Factory” where he described that factories can be more competitive if they have focused operations. The “one-size fits all” model means that a factory cannot perform well on every measure and that competence can be created by simplicity and repetition. Today, globalization and outsourcing have made supply chains more complex to handle and supply chain teams need to execute a set of processes and handle many performance metrics (Culey, 2012).

In every organization, it is needed to understand the customer requirements and find ways to satisfy their needs. Hoffman (2012) argues that this means that one single supply chain cannot satisfy all customer requirements as they vary across various marketplaces. Add to this mix is product volume and variety, different service levels and different planning and scheduling tool and the need for segmentation increases (Culey 2012; Hoffman 2012; Aitken et al., 2003). Excellent logistics customer service can be seen as a competitive advantage and one key step is to determine the customer needs and respond to them (Huiskonen & Pirttilä, 1998).

This has led to the relevance of supply chain differentiation which means that companies segment their supply chain. One of the most promising journeys was made by Dell that went from a single supply chain to a customer segmentation supply chain approach. As from 2008 to 2010 Dell could lower operational cost by approximately \$1.5 billion (Davis, 2010). The approach to segmentation starts with the customer, understanding the structure, behavior, and strategies of what the customer sees as value (Culey, 2012)

1.2 Purpose

The purpose of this thesis work is to examine and map the current logistics service elements in contracts and tenders. This is the first step of understanding customer needs and requirements. The researcher will attempt to go one step further and present a possible supply chain strategy based on the elements identified.

1.3 Limitations

This thesis work is done in Mölnlycke Healthcare head office in Gothenburg and the data collected are for the Swedish market and customers. To complete this thesis work a broad range of business, supply chain and marketing theories were studied. However, this thesis work is not examining the follow areas within company: The reasons for this limitation were set together with different stakeholders and takes to account of the balancing of time and resources.

- Supply or Business networks
- Purchasing management
- Supplier or transportation relationship

The logistics processes of focus for this thesis is illustrated below in figure 1.



Figure 1. The logistics processes of focus

1.4 Research questions

The first research question is focusing on the examining the current state and understand what is required by the customers in the contracts.

1. What logistics elements and its values are stated in various contracts?

The second research questions aims to connect the first research question with statistical data to examine different supply strategy approaches. The author answers this question by connecting to the theoretical framework and give recommendations to the company.

2. How the identified service elements together with statistical data support differentiated supply strategy?

The detailed theoretical framework of this thesis provides the company a theoretical frame of reference by showing different tools and strategies for supply chain segmentation. This is connected to the second research question.

1.5 Dissertation structure

In order to fulfill the academic requirements the structure as shown in figure 2 below was created

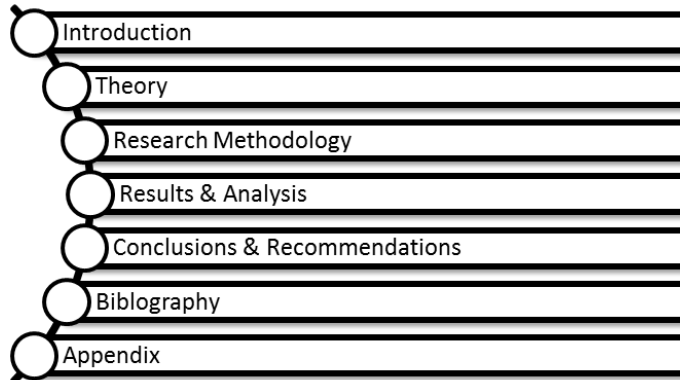


Figure 2. Dissertation structure

1.6 About Mölnlycke Health Care

Mölnlycke Healthcare is one of the world-leading medical product and solutions company. The company was founded in 1849 as a textile manufacturer. In the 1900s the company had become a main supplier to Swedish hospitals. Through product inventions the company has a broad product portfolio within surgical gowns, wound management and as well turning and positioning systems for the health care settings. Figure 3 below shows example of three products categories in the company's product portfolio.



Figure 3. Mölnlycke Health Care products. Source: Internal company document (2014)

The company design and supply products and solutions in a range of areas such as wound treatment, pressure ulcer, and surgery. Today, 7500 employees reaching over 90 countries are working towards the mission to “outstanding solutions for safe, efficient surgical procedures and gentle, effective wound care”. The headquarters is located in Gothenburg, Sweden. Mölnlycke healthcare has 15 manufacturing sites and sales through distributors in 63 countries.

2. THEORETICAL FRAME OF REFERENCE

This chapter will focus on presenting the theoretical framework that is needed in order to understand the following chapters in this thesis work. This chapter is divided into two sections: Supply Chain Management Overview and Supply Chain Segmentation. The first section will give the reader an introduction to supply chain management and present some underlying methods used in this work. In order to understand supply chain segmentation, some basic topics regarding supply chain strategy and manufacturing will be covered shortly in order to provide necessary insights. The second section will build upon the first section and present the supply chain segmentation process.

2.1.1 What is Supply Chain Management?

The concept of Supply Chain Management (SCM) is getting more attraction and gaining in importance. In recent studies, many executives stated the importance of SCM from a practitioner's point of view. Also in the academics, the number of SCM articles continue to grow since the 1990s. The Supply Chain Council, the worldwide professional association of supply chain management defines a supply chain as:

“All product (physical material and service) transactions from your supplier's supplier to your customer's customer, including equipment, supplies, spare parts, bulk products, software etc.”

(Supply Chain Council, 2008, p.3)

The research of Stock and Bayer (2009, p.706), gives a definition of supply chain management as:

“The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction.”

(Stock and Bayer, 2009, p.706)

Huan et al. (2004), states that SCM research can be classified into three categories:

Operational, Design and Strategic. The authors explain that the **operational area** is focusing with the daily operation of a plant or a distribution center. The goal is to make sure to find the most profitable way to fulfill customer order. The ways to execute this can include inventory management or planning and scheduling with mathematical tools. **The design** of a supply chain is focusing on the location and the objectives of the chain (Mourits and Evers, 1995 cited in Huan et al. 2004) The authors explains: “a good design should integrate various

elements of the supply chain and strive for optimization of the entire chain rather than individual entities” (Huan et al. 2005, p.23)

The strategic focus is decision that are made by business managers and this requires understanding of the dynamic of the whole supply chain (Gopal, 1992 cited in Huan et al. 2004). Also, this requires critical evaluation of the alternative supply chain configurations and enhance that the firm is competitive among the network of supply chains.

The most common model cited in SCM research is developed by the Supply Chain Council and AMR. The Supply Chain Operations Reference (SCOR) model is used to identify measure, reorganize and improve supply chain processes (Näslund & Williamson, 2010). Huan et al. (2004) describes that model includes four distinct processes: Source, make, deliver and plan. The authors explain more in detail in their own words: “These processes are defined in increasing levels of details beginning with a description of the overall process” (Huan et al. 2004, p.24). Figure 4 gives a schematically view of the supply chain infrastructure:

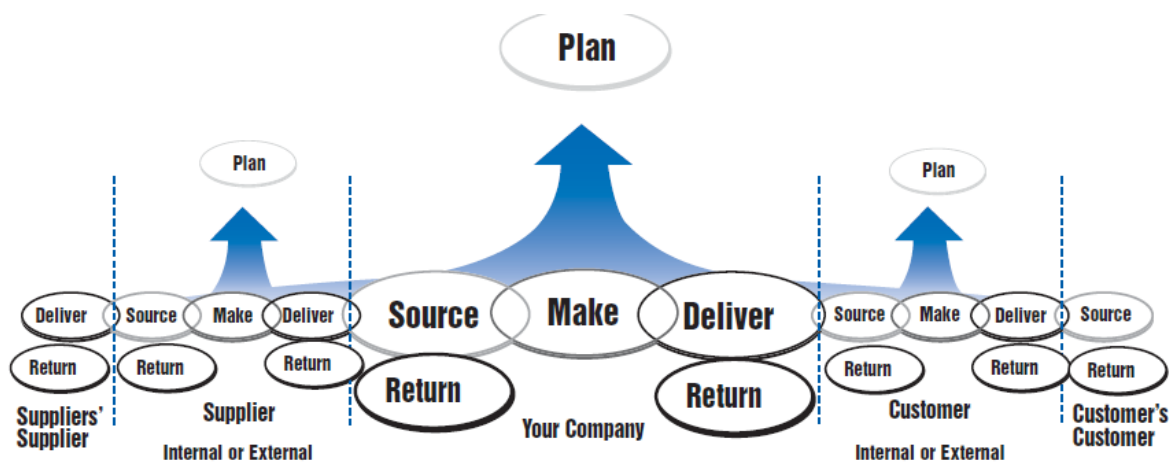


Figure 4. The SCOR Model Source: (Supply Chain Council (2008, p.3)

The SCOR model provides a set of supply chain performance metrics together with industry best practices and allows firms to make fact based analyses of all aspects in the current supply chain. Näslund & Williamsson (2010, p.13) explains “The source, make and deliver processes of the SCOR model create a continuous chain of activity throughout a company’s internal operations; and potentially across the whole inter-organizational supply chain”. The authors state that to be successful with SCM, the firm need to focus on process orientation and process management. These two areas are important since “an organization’s value-adding capability depend on how well cross-functional processes are managed” (Näslund & Williamsson, 2010, p.22) The SCOR model is one framework that focuses and promotes cross-functional collaboration (Huan et al. 2004)

Learning points:

As described by Huan et al. (2004), SCM research consists of three categories: Operational, design and strategic. In the strategic area, understanding the dynamic of the whole supply chain is needed to evaluate different supply chain configuration. Hofmann et al. (2012), state the importance of the interrelation of supply chain strategies and business environment and

the need to be considered from the customer's and the firm's perspective. Achieving a differentiated supply chain build upon aligning suitable supply chain strategy to given customer segment. (Hofmann et al. 2012). In order to understand supply chain segmentation, some basic topics regarding supply chain strategy, manufacturing and finance will be covered shortly in order to provide necessary insights.

2.1.2 Logistic Service Offering and Quality

Understanding the marketplace and customer requirements is needed to adjust supply chains to match the requirements of the customers. However, Hoffman et al. (2012) state that this is a complex process which requires resources and time. To provide an overview of customer requirements, Naylor et al (1999) categories four strategic needs: Lead time, quality, flexibility and price. This is shown in the figure 5 below and also shows some performance metrics in each category.

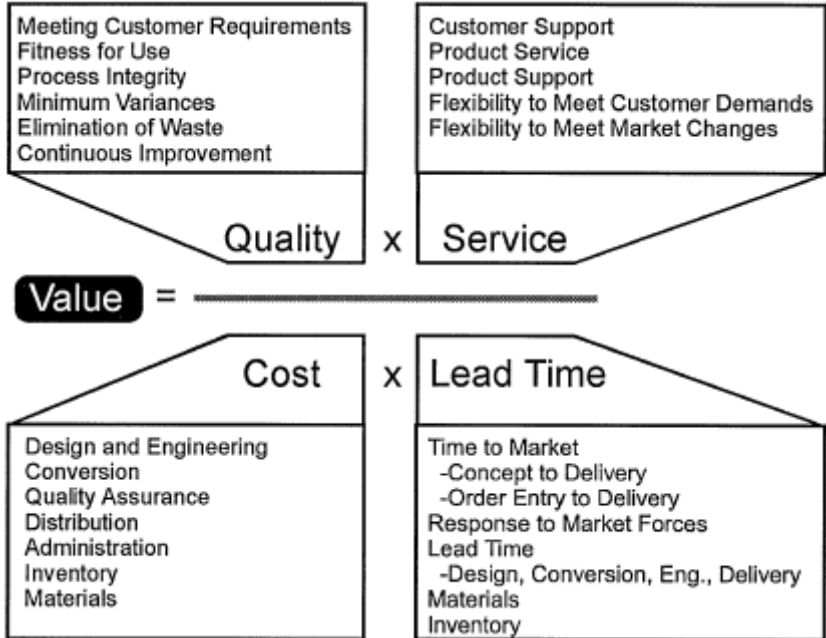


Figure 5 Value Metrics in Supply Chain Source: (Naylor et al. 1999, p.3)

In summary, lead time can be described as the speed of a company and include the time for delivery. Quality can be defined as what the customer requires and is willing to pay for. Flexibility includes being adaptable to market changes and the range of customer support. And the final dimension, cost, is referring to the actual price of the product or service

Theory about service offering is to be found in service management and marketing. Atkacuna & Furlan (2009) have reviewed number of sources and found that service package consists of core and supplementary service. A core service is related to the company being on the market and from the customer's perspective as vital (Grönroos 2000 cited in Atkacuna & Furlan, 2009). The supplementary service or augmented service offering can be seen as basic service package and three other elements. The three elements are: **accessibility of the service, interaction with the service organization and customer participation.** As one example,

accessibility of the service can be the service provider's office hours (Grönroos 2000 cited in Atkacuna & Furlan, 2009)

Adding to aspect of service elements, the service quality is important and connects to customer satisfaction and loyalty. Kasper et al (2006 cited in Atkacuna & Furlan, 2009) describes five dimension of service quality: **Reliability, assurance, tangibles, empathy and responsiveness.**

In today's business environment many companies have outsourced logistics functions to **third party logistics providers** (3PL) and take advantage of their knowledge and economies of scale (Atkacuna & Furlan, 2009). Bask (2000 cited in Atkacuna & Furlan, 2009, p.1) defines the term third-party logistics as a situation "where the logistics provider servers two parties in the supply chain". There are number of frameworks focusing on the activities of logistics service provides and their classifications of functions. Ahl and Johansson (2002 cited in Atkacuna & Furlan, 2009) defines four parts: **basic service, value-added services, administrative service and IT-services.** The term value-adding is defined as a service adding extra feature, form or functions to the basic service and is not traditionally offered by 3PL provider (Atkacuna & Furlan, 2009). Ahl and Johansson (2002 cited in Atkacuna & Furlan, 2009) gives two examples of value-adding services: Value-added service included in the contract such as labeling and value-added services such as dealing with goods damage during transportation.

Excellent logistics customer service can be seen as a competitive advantage and one key is to determine the customer needs and respond to them (Huiskonen & Pirttilä, 1998). The authors state that logistics customer service planning is carried out at strategic, tactical and operational level. On the strategic level decision is focused on customer segments and their service requirements. One way to offer a more detailed description of different service elements and their behaviors is by suing the Kano Model to identify logistics customer service. The reason is described by the authors: "Moreover, classification facilitates the recognition of different customer requirements, and hence improves customer service differentiation decisions" (Huiskonen & Pirttilä, 1998, p.254)

2.1.3 Supply Chain Quality in Healthcare

This section aims to present studies about supply chain quality metrics in the healthcare. The author sees this as a field for better understanding the customers from the healthcare setting and their requirements and complements the data collected in this thesis work.

Smith et al. (2011) describes in their study the increasing cost of providing healthcare in the US. One of the underlying factors was found to be healthcare supply chain to be immature. The authors explain that healthcare supply chain is different to other industries. They provide an illustrative view of the healthcare supply chain as shown in figure 6 below.

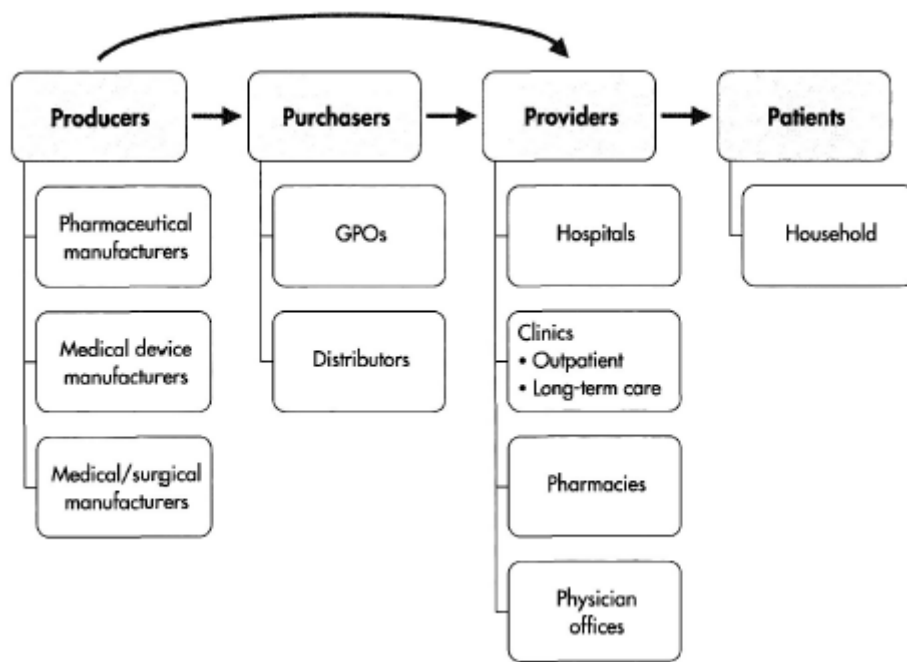


Figure 6 The Healthcare Supply Chain Source: (Smith et al. 2011, p.2)

Usually, the hospitals, clinics or pharmacies get goods directly from a producer or through a distributor or Group purchasing organization (GPO). From the healthcare perspective it is complex to manage the supply chain, issues such as visibility across the supply chain, regulatory issues and lack of planning both upstream and downstream are mentioned by the authors (Smith et al., 2011). One way could be to measure and improve performance across the healthcare supply chain. Smith et al. (2011) however found in their research that there is a gap in the literature in regards to supply quality metrics and what it means. While healthcare focuses on “**patient safety**”, manufacturing companies focus on “**profit**” as factor in supply chain quality. In their study they present the findings of factors influencing quality of the healthcare supply chain according to healthcare experts. The findings present both internal and external factors. These factors are illustrated in the table 1 below.

Table 1: Different factors in Healthcare Supply Chain Source: (Smith et al.2011)

Factor	Description
Availability of materials	Have what they need to the job at the time they need it
High volume of transactions	It is over 4000 or more transaction per month in a typical healthcare inventory system
Integrity of the supply chain	Understanding what happened to a product between the point of manufacture and the point of use is critical
Poor product traceability	If a product is recalled then problem arise in product identification and tracking
Process variation	In the healthcare supply chain a product can

	arrive at an organization in many different ways
Quality of information and its exchange	Rework because data is lacking integrity from manufacturer to bedside

In recent studies, the healthcare supply chain has gained more attraction and Kwon et al. (2016) shows three areas where supply chain operation can improve. The author's mentions **supplier relationship management, logistics operational tools and process improvement**. These areas are also in line with studies from Swedish healthcare settings. The Swedish healthcare system has attracted the methodology and principles from Lean and Agile philosophy (Arvidsson, 2007). The term "vårdlogistik" combines tools usually used in manufacturing settings to be applied within to healthcare for improving patient and product flow.

2.1.4 The Product Lifecycle: An Short introduction

The product lifecycle model defines four stages during a product lifetime (Hofstrand, 2007). The four stages are: Introduction, growth, mature and decline and is shown in figure 7.

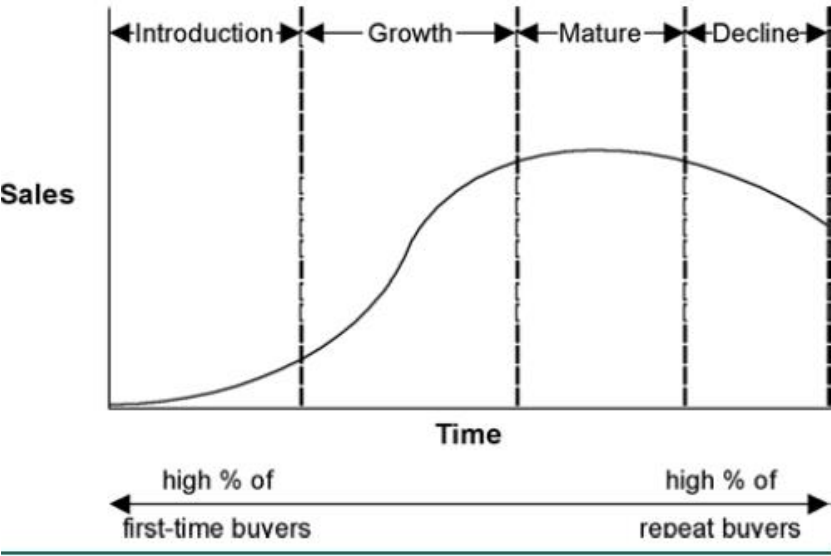


Figure 7 The Product Lifecycle Source :(Hofstrand, 2007, p.1)

In the introduction stage, the product needs to be introduced to buyers and sales are small. In the growth stage, buyers are familiar to the product and sales are increasing and competitors may enter the market (Hofstrand, 2007). In the mature stage, the markets have become saturated and sales are from repeat buyer. In the last stage, decline, buyers seek new product and fierce competition is leading to narrow profit margins (Hofstrand, 2007).

2.1.5 DMV³ Variables

In the section above four dimensions was presented to understand customer requirements. Adding to this, Christopher and Towill (2005) describes five variables that influence the design of supply strategies by the DMV³ variables. The variables encompass duration of life cycle, time window for delivery, volume, variety and variability. The different variables has link to the product life cycle characteristics and are summarized below.

Duration of life cycle: Depending on the stage of the product life cycle, different demand chain types can be used. Aitken et al., (2005), states that rapid-to-market can be used for short life cycles and lead times can be matched to the different stages.

Time Window for delivery: Identifying how quickly the supply chain should react to demand can give understanding what kind of strategy should be used for products. Also, there is a difference time window between standardized product compared to more complex and customized (Aitken et al., 2005)

Volume: Different strategies apply for mass produced product compared with products with smaller volumes. The volume will determine make-to-forecast strategies and flexibility in the demand chain (Hofmann et al., 2012)

Variety: The variety variable is considering the firms range of products and understand the variety demanded by the marketplace (Aitken et al., 2005). The variety and demand variability will effect stocking keeping units and high variety will influence both the supply chain and manufacturing processes.

Variability: The variability in demand is about the variation in demand and its unpredictability. If the demand forecast is uncertain then this will influence the production process (Hofmann et al., 2012).

2.1.5 Push and Pull: An overview

According to Kong & Allan (2007), push and pull model are two predominant systems in supply chain operation. Zhang & Zhao (2008) describes **that the push supply chain** as: “Push supply chain takes manufacturers as core enterprises, sells commodities to consumers designedly according to the production and repertory of products, which drive roots from the production of manufacturers in the upper of supply chain” (Kong & Allan, 2007, p.2). In this system, production and distribution decision are made based on the result of long-term forecast and looks to meet determined demand. Kong & Allan (2007) describe that in a push model: “stock is pushed up the supply chain” in order to ensure customer demand. The push system uses material requirement planning to build the reorder point and to plan production. In contrast, Kong & Allan (2007) state **that the pull system** moves inventory down in the supply chain to manufacturer. Pull supply chain focuses on consumers and is organize demand and production based on consumer demand. The pull system will have effect on inventory as this will create smaller batch size orders and the delivery frequency will be increased (Zhang & Zhao, 2008). The pull system uses tools based on Just-in-time and zero

inventory techniques. These two models can be used in supply chain operation and depend different factors such as on product characteristics, demand variability and customer drivers (Zhang & Zhao, 2008).

2.1.6 Decoupling point

Hoekstra & Romme (1992), describe the central role of the decoupling point in the controlling and planning of the flow of goods through a supply chain. Also, Olhager (2010) states that the customer order decoupling point (CODP) has integral role as input to the strategic design of supply chain Hoekstra & Romme (1992) defines the decoupling point as:

“The decoupling point is the point in the material flow streams to which the customer’s order penetrates. It is here where order-driven and the forecast-driven activities meet. As a rule, the decoupling point coincides with an important stock point – in control terms a main stock point – from which the customer has to be supplied.”

(Hoekstra & Romme, 1992, p.111)

Olhager (2010) states that CODP can be sometimes being referred to as the order penetration point and it are where the product is connected to the specific customer order. Naylor et al. (1999) defines strategies that deal with the control of material flow and how it depends of the position of the decoupling point. This is shown in figure 7 and also shows different manufacturing strategies and its material flow both downstream and upstream. This statement means that CODP has link to the chosen manufacturing strategy. A picture to illustrate both push and pull together with the decoupling point is shown in figure 8 below.

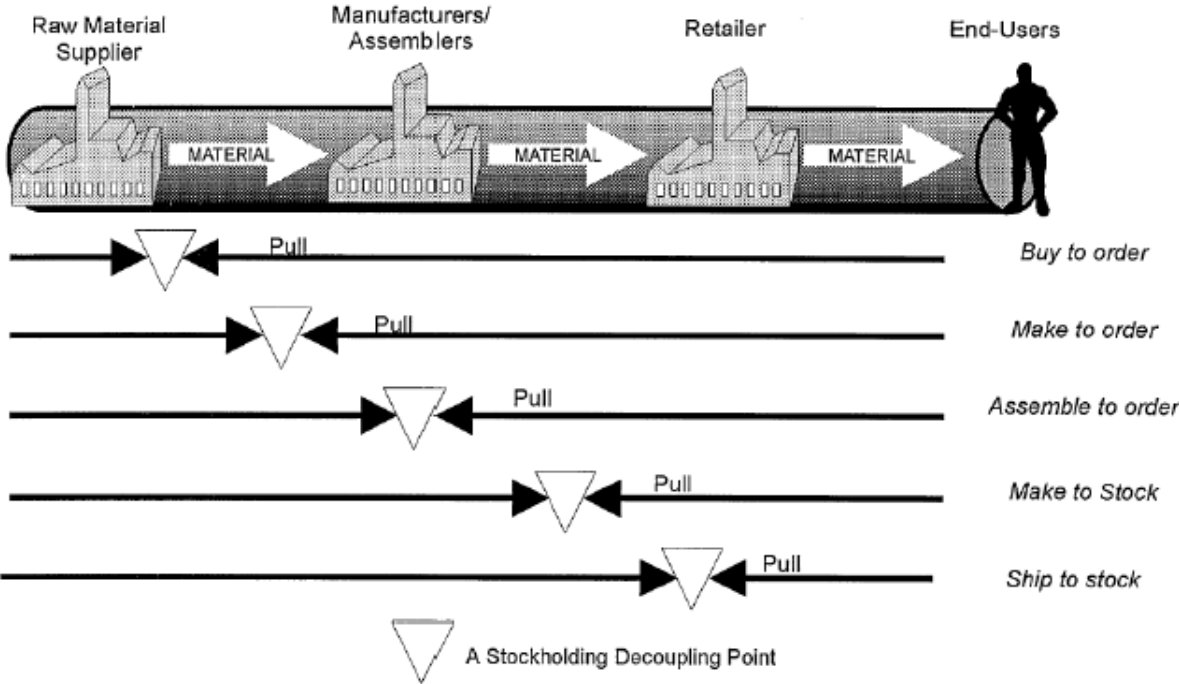


Figure 8 Different Supply Chain Strategies Source: Hoekstra (1992 cited in Naylor et al. 1999, p.7)

2.1.8 The Lean, Agile and Leagile Strategy

As described in sections above, supply chain design and strategy includes many factors. As complexity increases there is a need to improve performance for meeting demand and synchronize the supply chain (Christopher, 2001). The paradigms about Lean and Agile have been developed in the manufacturing setting, with the origins of Lean linking to the Toyota Production System. Table 2 below summarizes the lean and agile characteristics and some key points are described below

Naylor et al., (1999) provide a definition of leanness as: "Leanness means developing a value stream to eliminate all waste, including time, and to ensure a level schedule". Lean focuses on reduction and elimination of waste and implies "zero inventory" and "just-in-time" approaches (Christopher, 2001). In supply chain characteristics, lean have emphasize on efficiency and the goal is to have minimum stock holding.

One of the crucial characteristics of agility is flexibility and in the manufacturing setting this was enabled by automation, reduced set-up times and greater responsiveness in volume. Naylor et al., (1999) defines agility as: "Agility means using market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place". Christopher (2001) defines two important aspects in agility: Variety and Variability. If an organization is embracing agility, it is focusing on responding rapidly in changes in terms of volume and variety. This distinction between lean and agile is shown in the figure 9 below.

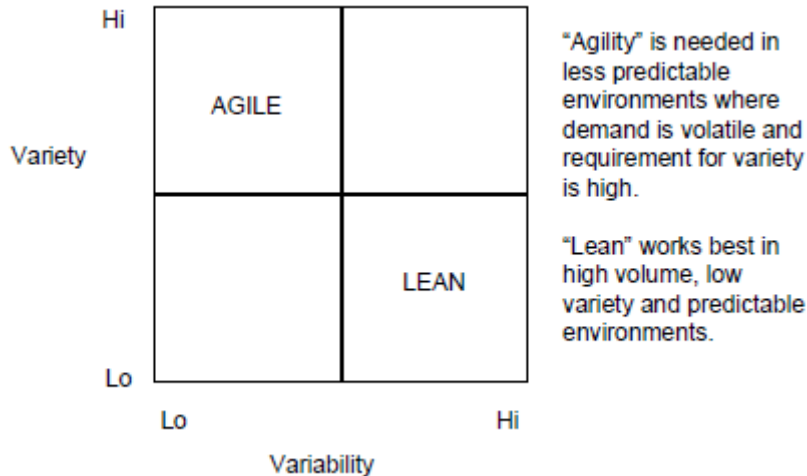


Figure 9 Difference between Agile and Lean Source: (Christopher 2001, p.2)

Christopher (2001) discusses an important issue, namely the common problem of limited visibility of real demand in supply chains. The authors suggest that supply chains tend to be forecast driven rather than demand driven, this due multiple levels of inventory looking from production to the final marketplace. As discussed in the section about decoupling point, enabling lean and agile supply chains will have different effect of the decoupling point. Christopher (2001) explains that in agile strategy it is desirable to carry inventory (semi-finished products) and postpone until final assembly or localization. Combining this strategy

with the benefits of level scheduling and high level efficiency creates the approach called leagile. The definition of leagile is defined by Naylor et al., (1999) as:

“**Leagile** is the combination of the lean and agile paradigms within a total supply chain strategy by positioning the decoupling point so as to best suit the need of a volatile demand downstream yet providing level scheduling upstream from the marketplace” (Naylor *et al.* 1997)

The figure below describes the leagile supply chain, combining both lean processes and agile processes. Christopher (2001) point out the importance of understanding that there are two decoupling points, the first is the “material” decoupling point and the second is the “information decoupling point”. Table 2 below summarizes the differences between lean and agile methodology.

Table 2. The differences between Lean and Agile

	Lean	Agile
Objectives	<ul style="list-style-type: none"> ▪ Low Cost ▪ High Utilization ▪ Minimum stocks 	<ul style="list-style-type: none"> ▪ Fast response ▪ Buffer capacity ▪ Deployed stock
Process Characteristics	<ul style="list-style-type: none"> ▪ Elimination of waste ▪ Smooth operation flow ▪ High level of efficiency ▪ Quality assurance 	<ul style="list-style-type: none"> ▪ Flexibility ▪ Market sensitivity ▪ A virtual network ▪ Postponement
Product Characteristics	<ul style="list-style-type: none"> ▪ Functional product ▪ Low variety ▪ Low margin 	<ul style="list-style-type: none"> ▪ Innovative products ▪ High variety ▪ High margin

2.2 Supply Chain Segmentation

2.2.1 Setting the scene: Introduction

Becks (2010) mention the globalization and outsourcing as reasons for companies with more single-supply chain not meeting requirement of their major customers. As complexity and interdependence raises the need for a modern and adaptable supply chain processes increases Becks present supply chain segmentation as grouping customers with similar fulfillment needs and then develop an individual supply chain operation to meet these requirements. In the authors words: “As its core, supply chain segmentation is a process of grouping customers by shared sets of values, then developing supply chains that can profitability meet the needs of each customer group in its own terms”(Becks, 2010, p.2). A view of the segmented supply chain is shown in figure 10 below.

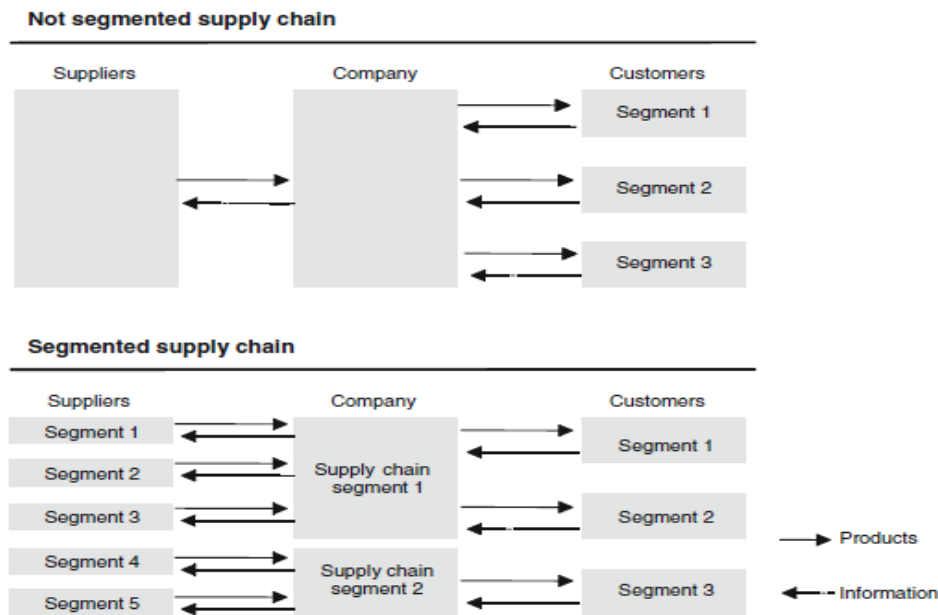


Figure 10 Segmented vs Not Segmented Supply Chain Source: (Hoffman et al. 2012, p.4)

Davis (2010) presents the journey of Dell Supply Chain Segmentation journey. The main drivers were the ever-changing customer needs, product commoditization, low-cost competitor and global requirements. Culey (2012) also mention that supply chains have become more complex and pose both internal and external risk. The author discuss that many organization want to grow at all cost to the lowest cost but that this mindset is not successful in the long term. In his article, Culey (2012) mention the term “Value Chains” designed to deliver customer value. The author mentions that it is vital for businesses to understand their customer needs and how to add value to the customers. This will create an “end-to-end organization geared to deliver products and services that the customer would choose over the competition”. The approach to create Value Chains means that focus will be to work from the customer back and understanding the structure, behavior and strategies that will provide the customer what they value. For the firm to deliver these values, it needs to evaluate their people, processes, measures and systems. In many industries and sectors the awareness of the importance of SCM has increased driven by factors of globalization, outsourcing, trade barriers and government regulations. These external factors together with internal motives have increased the complexity of supply chains (Hoffman, 2013). This means that one single supply chain cannot satisfy all customer requirements as they vary across various marketplaces. This has led to relevance of supply chain differentiate based on supply chain segmentation which means that companies segments their supply chain. The authors describe studies showing that they companies can achieve better delivery service while lowering logistics costs by keeping inventory low.

2.2.2 Different approaches to Supply Chain Segmentation

In the case study of Dell, Davis (2010) presents key findings about Dell’s journey. The need to change market and business strategies required the company to rethink their supply chain approach. The transformation required cross-functional collaboration between different functions within the company. For instance, the segmentation started with a Cost-to Serve methodology where supply chain worked with finance. In the end-result Dell went from a single supply chain approach to a customer segmentation supply chain approach. As from 2008 to 2010 Dell could lower operational cost by approximately \$1.5 billion.

Davis (2010) describes the transformation and present six different phases. In table 3 below, the different phases are summarized.

Table 3 An approach to Supply Chain Segmentation Source: (Davis, 2010)

Phase	Recommendation on what to do
1. Identify Customer Values	Use historical customer information from contracts and surveys
2. Understand the firms Strength	Understand what needs to be changed and what customer values needs to be retained
3. Understand the External Environment	Use benchmark to find best practice’s from a variety of industries
4. Chart Clear Course and Benefit	Create a basic framework and design the new supply chain
5. Engage the Entire Organization	The transformation require cross-functional collaboration, for example, supply chain need to work with finance
6. Continue to Govern and Refine Portfolio	Continuous improvement by lean methodologies to maintain a focus on customer values

The authors describes that the first step of the segmentation was by understanding the company’s customers and channel in order to understand demand rhythms and cycles. Further, analysis of isolating and quantifying costs was done by looking at Cost-to-Serve methodology to understand profitability and costs to each business decisions. Becks et al., (2012) provides a schematic view of the basic principle of Dell’s supply chain differentiation as shown in figure 11 below.

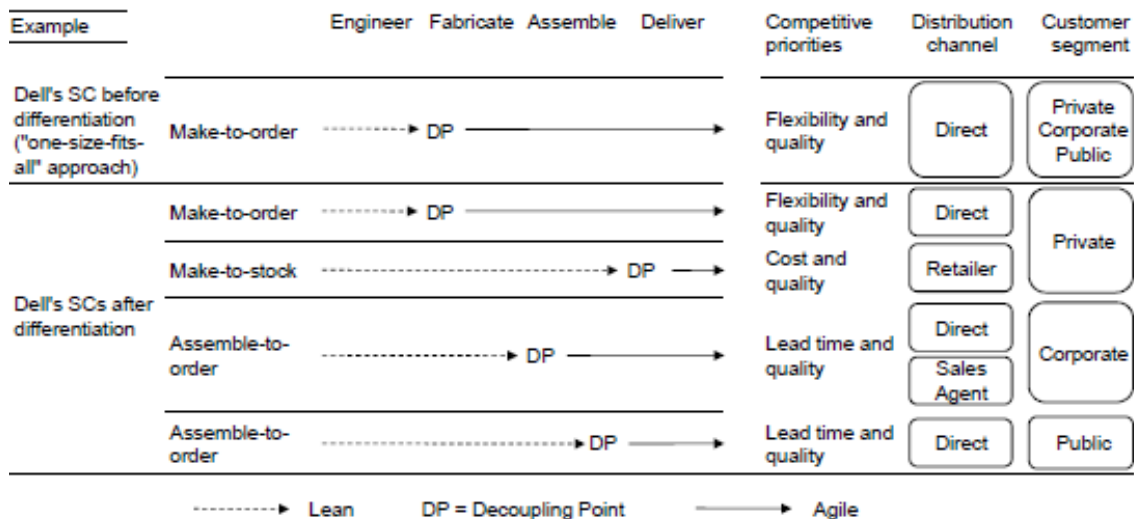


Figure 11 The view of Dell's Supply Chain Differentiation Source: (Hofmann 2012, p.6)

According to one of the leading consultant firms on supply chain segmentation, Ops Rules supply chain segmentation is described as:

“The dynamic alignment of customer channel demands and supply response capabilities optimized for net profitability across each segment” (Bender, 2014, p.1)

Ops rules focuses on consultation of supply chain transformation, presents a six step to perform supply chain segmentation (Bender, 2014). These are summarized in Table 4 below.

Table 4 An approach to Supply Chain Segmentation (Bender, 2014)

Phase	Recommendation on what to do
1.Ensure your customer value proposition is clear across segments	Ask and understand the firms unique value proposition and evaluate customers preference and needs
2.Match Operations Strategy to Customer Value	Balance the firm's operations strategy to meet the customer needs.
3.Reduce Complexity	Use customer analysis to understand purchasing and profitable levels.
4.Design for Supply Chain	By using and placing processes and tools evaluate the supply chain design
5.Discover synergies	Examine the value proposition to customer segments and find synergies
6.Expand End-to-End Integration	Align and integrate Sales and Operation Planning process across all supply chain segments

In the first steps as shown in the figure, calculating and understand cost and variability is seen a critical component. The assessment should focus on logistics costs, costs to configure or assemble and lead time analysis.

Tathagata from the consulting firm EY (2012) suggest that there are five ways to approach segmentation and these are summarized as shown in table 5 below.

Table 5 Five ways to approach segmentation Source: (Tathagata, 2012)

Supply Segmentation based on:	Why segment:
1.Product complexity	<ul style="list-style-type: none"> • Number of product variants • Volume complexity
2. Risk and resiliency	<ul style="list-style-type: none"> • Unexpended disruptions
3.Manufacturing process and technology	<ul style="list-style-type: none"> • Different product technology
4. Customer service needs	<ul style="list-style-type: none"> • Service-level-based • Standard, high-quality and premium service levels
5.Market-driven	<ul style="list-style-type: none"> • Demand patterns (seasonal) • Customer groups/segments

These five categories take into account different aspects, for example, variants of products, life cycle variability or the different methods for production. The dimensions help the understanding of identifying, assessing and profiting of the segmentation journey. Price from consulting firm EY (2012) identified four characteristics that are important for developing and gaining understanding of supply chain segmentation. These four characteristics are summarized below

1. Understanding the demand by volume and variability can help to see demand changes
2. Look at the supply chain for understanding lead time for planning and materials
3. From the market point of view ask a set of questions, such as, how do you transport product to different markets?
4. Understand the different channels of serving the customers and their needs

Beck et al., (2012), describe the term supply chain differentiation that focuses on understanding and meeting the needs and requirements of each customer. These require an appropriate Supply Chain Strategy and move beyond the thinking of “one-size-fits-all” approach. The authors present their framework and as described above, the starting point is the customer and their requirements. Their framework aims to give an overview over the complex endeavor of supply chain differentiation. This is shown in figure 12 below.

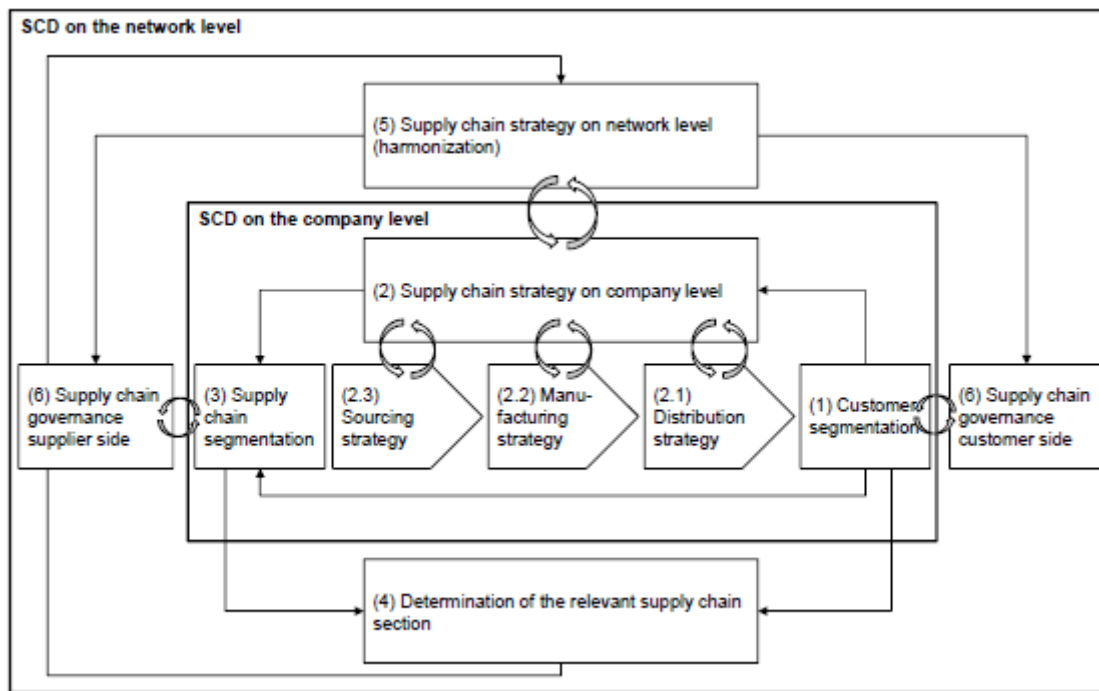


Figure 12 Supply Chain Differentiation framework Source: (Beck et al. 2012, p.8)

To support managerial implications the identified four different triggers for supply chain differentiation. To illustrate an example, the authors present a schematic view of supply chain differentiation. It consists of the terms introduced in previous section such as: manufacturing strategy, supply chain strategy and demand forecasting. Becks et al., (2012) states that “several intra- as well as inter-organizational aspects have to be considered” when designing a segmented supply chain (Becks et al., 2012, p.9)

2.2.3 Tools for supply chain segmentation: Customer analysis

In the previous sections, the importance of starting with analyzing the customer needs and requirements has been stated in different studies. Becks (2010) describe supply chain segmentation focal point to be about grouping customer by shared values and then design supply chain to meet their requirements. Davis (2010) describes the Dell transformation journey and the first step was to identify customer values. This was done by using following methods and tools: Customer knowledge from contract, Surveys, Business Intelligence data and platform sales (Davis, 2010).

Becks (2010), suggest that the simplest way to segmentation model are by two-by-two matrix. Here the authors give two suggestions as shown in figure 13.

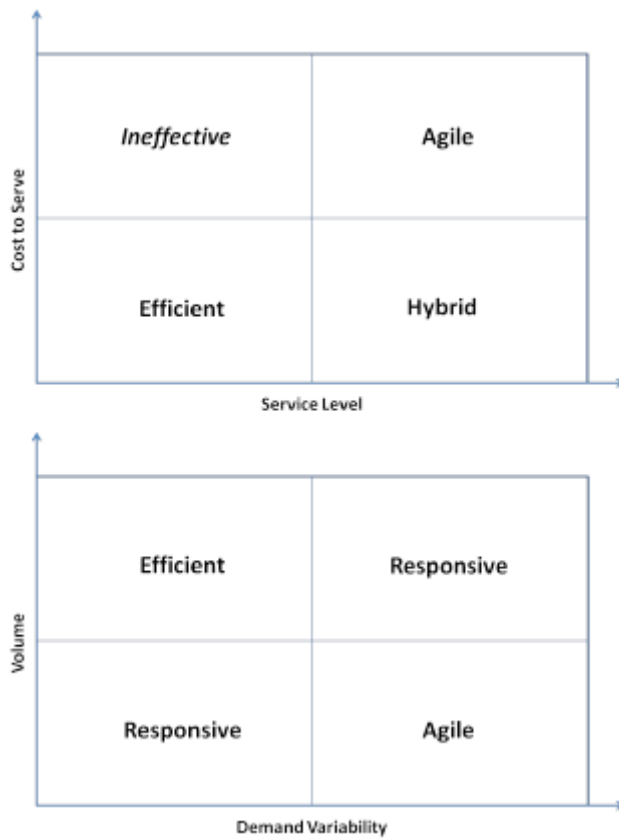


Figure 13 Example of two-axis analysis Source: (Becks 2012, p.3)

Another possible way to map the customers is by using three-axis models or by radar diagram. A three-axis model is shown below in figure 14.

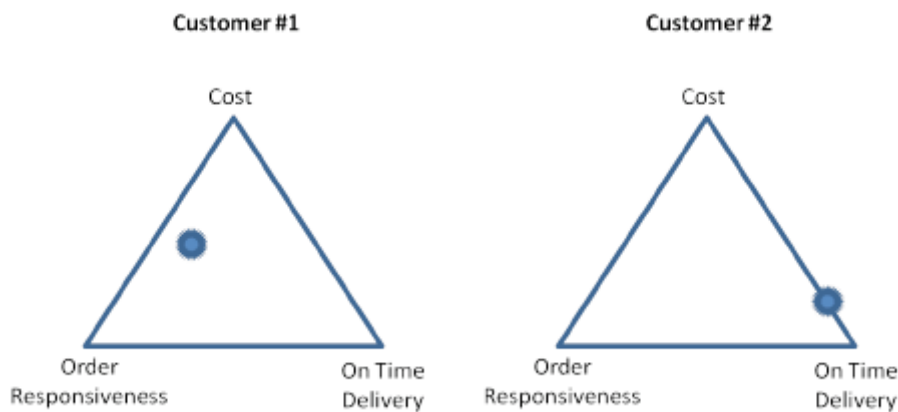


Figure 14 An example of three axis analysis (Becks 2012, p.4)

This enables to see how customers will value key attributes. The data can be extracted by using customer interviews, surveys, financial data and internal company knowledge (Becks, 2012).

Another approach is to analysis customer with respect to DMV³ variables. As described in the previous sections, the variable are demand variability, product variety, demand variability, duration of product lifecycle, responsiveness of order cycles, and volume of annual product demand. These variables can be used to define customer segments based and execute supply chain strategies according to these findings (Hoffman, 2012). An example of this analysis was performed in a study by Childerhouse et al., (2012), and is shown in figure 15 below.

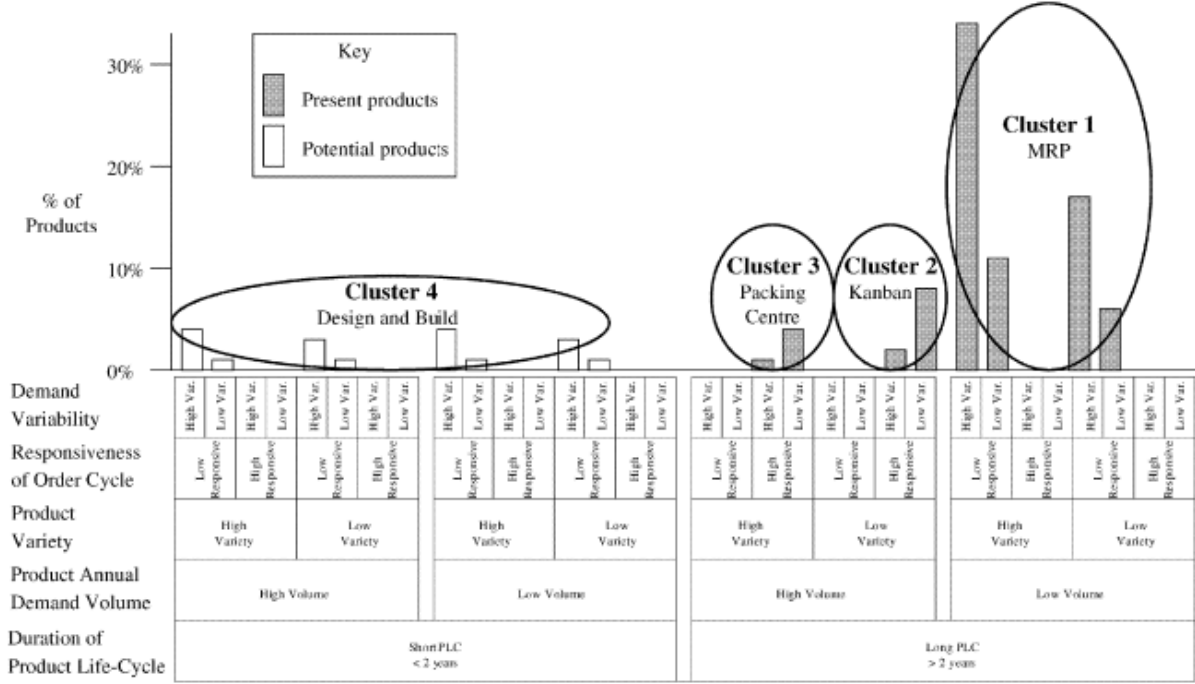


Figure 15 An example of analysis and linking to supply chain strategies Source: (Childerhouse et al. 2002, p.681)

In the previous section, the product lifecycle was introduced. The product life cycle stages have close connection when enabling supply chain segmentation. At present business environment many firms have one supply chain team that executes a set of processes people and performance metrics (Culey, 2012). The author points out that the team need to manage many products with different order strategies. One way to examine the complexity of this traditional way of working is by looking at the product life cycle stages. The impact of product life cycle on supply chain strategy is also described by Aitken et al. (2003); the author’s state the need for match of supply chain segmentation and tailoring the logistics channel to meet supply chain strategy as shown in figure 16 below.

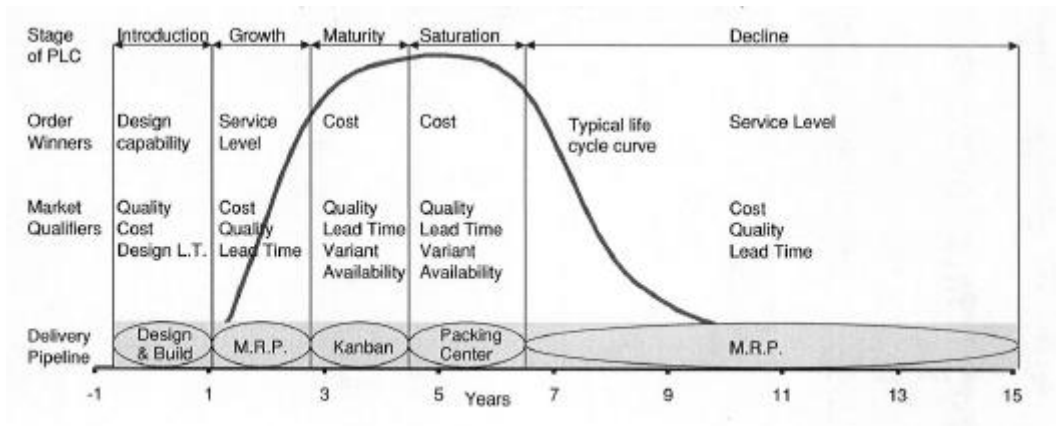


Figure 16 Product lifecycle and different strategies Source: (Aitken et al. 2005, p.15)

2.2.4 Linking to Lean, Agile and Leagile Strategy

Linking customer segments to the right supply chain strategy is also in focus when segmenting the supply chain. Christopher (2001) explains that three critical dimensions can be used to determine the correct approach. These dimensions are variety, variability and volume. Hoffman et al., (2012) also discuss these variables and present some descriptive characteristics for matching to right supply chain strategies. These are shown in figure 17 below.

Descriptive characteristics	Supply chain strategies		
	Lean	Leagile	Agile
Product	Functional	Hybrid	Innovative
Duration of product life cycle	Long	Short	Short
Prevalent strategies in the particular product life cycle stages	Introduction Growth Maturity Saturation Decline	Introduction Growth Maturity Saturation Decline	Introduction Growth Decline (dependent on market characteristics)
Window for delivery (lead times)	Dispensable	Small	Large
Product volume	High	Medium to High	Low
Product variety	Low	Medium to High	High
Demand variability (unpredictability)	Low	Medium	High
Geographic distribution of segments	National	National and Cross-national	National and Cross-national

Figure 17 Characteristic of Supply Chain Strategies Source: (Hofmann 2012, p .67)

3. RESEARCH METHODOLOGY

This chapter aims to present and evaluate the research methods. Further, this chapter is focusing to include a scientific basis and methods to answer the research questions of this thesis work.

3.1 Research Approach

Researchers have stated that they use either inductive or deductive research approach. The research approach used can determine the creation of well based arguments and therefore a logical approach should be chosen. **The deductive approach** is sometimes referred as a top-down approach and works from more general reasoning to the more specific (Burney, 2008). The process for deductive approach starts with theory and the conclusions is based on available facts. This is explained by Holmqvist et al., (2009, cited in Mustafa 2014, p.26) as: “The deductive approach explains by theory for general solutions or occurrences how an empirical problem in one case can be described”. The deductive principle can be seen as an experiment. The approach starts with forming a hypothesis and then test to it to verify or falsity the theory (Johansson, 2003). The inductive approach is instead a bottom-up approach starting from specific observation to a broader generalizations and theories (Burney, 2008). Induction is the opposite, starting with theory and uses a set of related concepts. This is suitable to verify a rule is applying in similar cases.

In the research made by Dubois & Gadde (2002); Pierce cited in Fisher (2005) show that in reality that both approaches are used. This type of research approach is identified as an abductive approach. Johansson (2003) describes abduction as: “the process of facing an unexpected fact, applying some rule and, as a result, positing a case that may be” (Johansson, 2003, p.9). The abduction reasoning is making generalization based on from cases to a case.

In table 6 below, the three approaches are summarized and an example of the order of rule, case and result changes are showed.

Table 6. The rule, case and result for three research approaches Source: (Svennevig, 2003 cited in Mustafa, 2014 p.26)

Deduction		Induction		Abduction	
Rule	All the beans from this bag are white	Case	These beans are from this bag	Rule	All the beans from this bag are white
Case	These beans are from this bag	Result	These beans are white	Result	These beans are white
Result	These beans are white	Rule	All the beans from this bag are white	Case	These beans are from this bag

Holmqvist et al., (2009, cited in Mustafa 2014, p.26) describes the abduction approach as

forming process of hypotheses where the approach is opened to new ideas. Dubois & Gadde (2002) adds the systematic combining process to the abductive approach and is described as:

“Systematic combining is a process where theoretical framework, empirical fieldwork and case analysis evolve simultaneously, and it is particularly useful for development of new theories.”

- (Dubois & Gadde, 2002, p.554)

3.2 Research Method

According to Cohen (2011), all researcher methods are either qualitative or quantitative. The qualitative method collects, analyzes and interpret data by observing what people say and do (Andersson, 2006). This method does not use statistical procedures and therefore is more “exploratory and open-ended” (Andersson, 2006). The quantitative method uses structured methods and explain the collected data by using mathematically based methods (Aliaga and Gunderson (2005, n.d.). Höst et.al, (2011, p.30), states that: “the study design is stable from beginning to end” which makes the method less flexible. The differences between the two methods are shown in the table 7 below.

Table 7. Differences between qualitative method and quantitative method. Source: (Mack et al., 2011 cited in Mustafa, 2014)

	Quantitative	Qualitative
General framework	Structured methods	Semi-structured methods
Analytical objectives	Quantify variations	Describe variations
Question format	Close-ended	Open-ended
Data format	Numerical	Textual
Flexibility in study design	Stable from beginning to end	Some aspects are flexible

Creswell (2014) present the possibility to combine both qualitative and quantitative research data in a research study. This method allows the research to collect, analyze and mix both qualitative and quantitative data (Creswell & Clark, 2011). This form a mixed method design is referred to as convergent parallel mixed methods and is explained by Creswell (2014, p.219) described as: “The researcher collects both forms of data at roughly the same time and then integrates the information in the interpretation of the overall results”.

3.3 Research Design

The definition of a case study is according to Yin (2009) the following:

“An empirical inquiry about a contemporary phenomenon (e.g., a “case”), set within its real-world context—especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2009, p. 18)”. According to Denscombe (2007 cited in Mustafa, 2014, p.35), case studies can be useful if the researcher wants depth and detail. However, the disadvantages with case studies are may not be the best method of for collecting data and the

researcher most make choices from among a number of events to people (Denscombe, 2007). Also, the trustiness of the investigation can be questioned because the results only have been collected from one study (Menyah, 2010 cited in Mustafa, 2014, p.35). To carry out a case study, several approaches to obtain evidence exists and they are summarized in table 8.

Table 8. Variation of approaches to conduct a case study. Source: (Menya, 2010 cited in Mustafa, 2014)

Type	Description
Illustrative Case Study	Describing the main characteristic of a real world example. The aim is to clarify an idea or reinforce an argument
Exploratory Case Study	Aiming to understand what happened within a case by studying the surround context
Explanatory Case Study	Attempts to explain why certain behavior occurred by finding out causes and effects

Case study design can be used to examine a “case” in-depth and may involve answering “how” and “why” questions (Yin 2003 cited in Baxter & Jack, 2008). It is also not possible to change or manipulate the behavior of those involved in the study. Rose et al. (2015) describes that case studies is used in management research because it investigates the case in depth and also uses multiple sources of evidence. The authors stated that this method can also be used about investigating processes as it uses multiple data sources and “supports the retrospective investigation of events (Rose et. 2015, p.3)

3.4 Data collection methods

3.4.1 Literature studies

In order to increase the knowledge about the different aspect of Supply Chain Segmentation, an extensive literature review will be required. According to Bryman & Bell (2011), a literature review can be seen as one of the most important parts in carrying out a research project. The authors state that there are numerous of reason of why a literature review is important, such as justification of the research question and for building the research design. The search words and phrases that were used in the Chalmers Library search database were;

Supply Chain Management; Supply Chain Segmentation; Supply Chain Differentiation; Lean Supply Chain and Agile Supply Chain; Healthcare Logistics; Logistics Service Offer

3.4.2 Documents

According to Denscombe (2007, p.212 cited in Mustafa 2014, p.36), the strategy of a survey can be applied to documents as well as living people. Further, the documentary research can

be used when “background information needs to be used as a platform for a research project or when secondary data need to be collected”. As a result of reviewing documents, the researcher can easily obtain data from a wide range of documents recorded (Wharton, 2006 cited in Mustafa 2014, p.36). However, the disadvantage of document research is the fact that the credibility of the source can be questioned (Walker, 1999 cited in Mustafa 2014, p.36)

3.4.3 Interviews

In general, interviews are most commonly made face-to-face and the researcher and the person interviewed can see each other and be near each other (Denscombe, 2007 cited in Mustafa 2014, p.36). Creswell & Clark (2011), states the advantages of interviews to be: flexible; give good insight in people’s experience; opinions and attitudes. For this thesis work the interviews have been unstructured interviews. It is cost efficient than depth interviews but can lack the means to produce creative explanations. Its flexibility has allowed the author to make conversations with employees within the organization during the workday. The author took notes during the conversations and did not record any conversation to make the interviewee feel comfortable and share valuable insights.

3.2.4 Observations

According to Zikmund et al., (2013, par.3 cited in Mustafa, 2014, p.35), observation is described as: “A systematic process of recording behavioral patterns of people, objectives and occurrences as they happen”. This indicates the less need of questioning or communicating. The data is collected through witness and recorded information while watching a certain event take place (Zikmund et al., 2013 cited in Mustafa, 2014 p.35). Further, there are according to Zikmund et al., (2013), two types of observations: visible observation and hidden observation. The main difference is that in the visible observation, presence of the observer in the subject is known (Zikmund et al., 2013).

3.4.5 Cost-to-Serve (CTS) Methodology

Understanding the cost to serve customer is needed to get insight of the drivers for profitability (Joshi et al., 2014). A CTS analysis provides an insight to the dimension of cost to serve for a particular product or product category. It also takes several dimensions into account, such as, procurement, manufacturing, distribution, logistics and sales (Joshi et al., 2014). The calculations for the cost to serve are derived from activity-based methodology. The activity-based costing traces cost related to activities and then to producing the product. The strength of cost to serve is it includes all activities to complete the customer delivery and considers end-to-end overview of the whole supply chain (Joshi et al., 2014). It can also help companies to adjust their service level they provide to each customer, identify areas of cost reduction and generate more profitability. The company had already built most of its database and the research utilized the data available.

3.4.6 The Kano Model

The Kano Model was developed by professor Kano and his coworkers in 1984. The model is used to better understand how the customer evaluate and perceive quality attributes (Lofgren

& Witell, 2005). In the model, there are five categories of perceived quality: attractive, must-be, reverse, one-dimensional and indifferent. Looking closer of three of these dimensional, must-be quality are taken for granted when fulfilled but if not fulfilled it leads to dissatisfaction (Lofgren & Witell, 2005). The one-dimensional quality attributes leads to satisfaction when fulfilled and often those attributes are which companies compete (Gustafsson 1998 cited in Lovgren & Witell 2005). The attractive quality attributes will surprise and delight customers when they are fully achieved but don't cause dissatisfaction when they are not fulfilled. Lofgren and Witell (2005) describes that the quality attributes are dynamic and changes over time, for example attractive quality will become one-dimensional and finally become must-be. The Kano Model, see figure 18 is created by an in-depth investigation of customer needs via a Kano questionnaire (Lofgren & Witell, 2005)

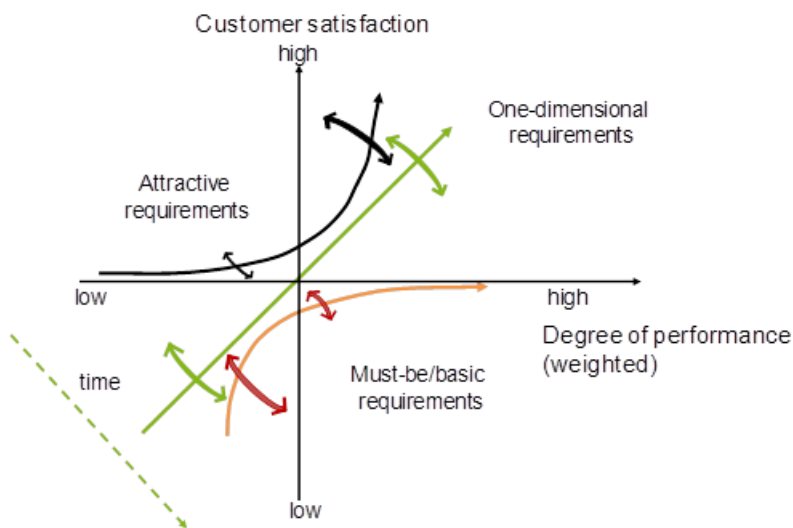


Figure 18 The Kano Model (Office Clipart 2010)

3.4.6 Validity and Reliability

Creswell (2014) defines the term qualitative validity as “*the researcher checks for the accuracy of the finding by employing certain procedures*” (Creswell, 2014, p.201). In contrast there is the qualitative reliability which is defined as following: “*qualitative reliability indicates that the researcher’s approach is consistent across different researchers and different projects*” (Gibson, 2007 cited in Creswell, 2014). Research validity is about how accurate the findings are of the researcher or the participants. Creswell (2014) explain the terms associated with validity are for example trustworthiness or authenticity. In this master thesis four strategies will be used for increasing validity and reliability (Creswell, 2014).

1. By examining different sources the triangulation of data can be increased
2. For every finding, provide a detailed description and offer many perspective about a theme
3. In the study, be not afraid to present contradictory evidence in order to give many perspectives
4. Set up a well-structured way to document the findings, procedures and the steps they consist of

3.5 Reasons and Applications for the Selected Methodology

Case study design can be used to examine a “case” in-depth and may involve answering “how” and “why” questions (Yin 2003 cited in Baxter & Jack, 2008). It is also not possible to change or manipulate the behavior of those involved in the study. The author used multiple sources of data collection methods to strengthen evidence. As shown in the figure collecting and reflecting about the data was a cyclic process. For example, when the researcher found interesting information in the contracts, the CTS methodology was used to examine the information further. Figure 19 shows the design of this research

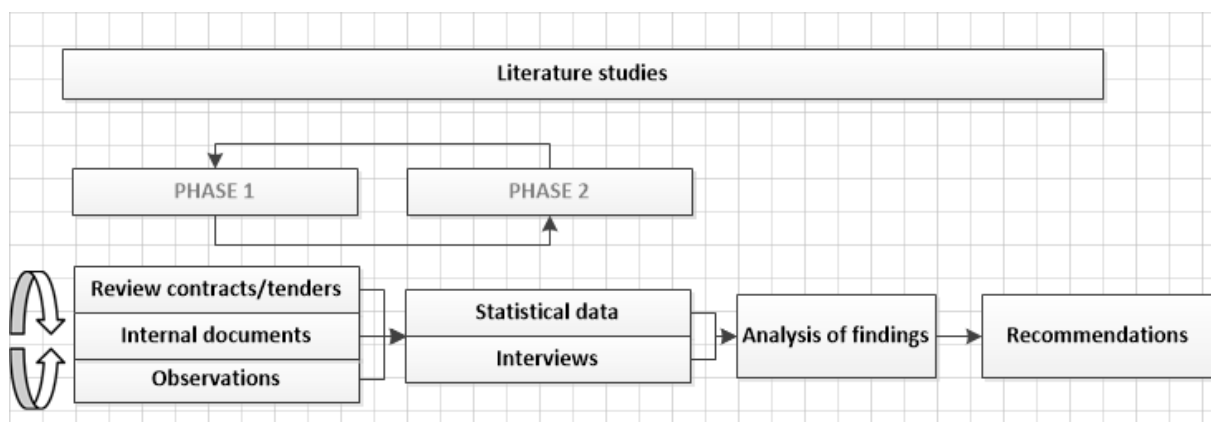


Figure 19 The research design for the study

Phase 1 was a chance for the researcher to get an introduction to the company’s way of working. This was done by starting to review documents and get familiar with the company’s logistics processes. Parallel to this step was an extensive literature research and unstructured interviews or conversations with the company representatives. Phase 1 continued with the review of contracts and tenders from the customers. In phase 2, the findings from phase 1 were combined with statistical data and interviews. It was a cyclic procedure where the researcher needed to go back to reviewing and comparing data from both phases. Phase 2 used the theoretical methodology to identify a possible supply chain strategy for different customer segments.

3.5.1 Phase 1: The reviewing of contracts

The researcher needed to look for logistics terms in the contract and categorize them accordingly. In total 15 contracts were examined and the researcher used the SCOR performance metrics and adapted them for categorizing the contracts. The categories were: **Payment terms, delivery agreements, packaging requirement, conformance, order responsiveness and penalty agreement**. All data were sorted in Microsoft Excel software and in each category different attributes were identified. Figure 20 shows an example of the design of the categorization. Due to a confidential agreement, the researcher will not present the detailed insight of the logistics attributes identified.

Customer →	SL	JL	Norr	SL
Product category →	Surgery	Surgery	Surgery	Dressing
Attributes ↓	County	County	County	County
30 days of payment	•	•	•	•

Figure 20 Categorization by customers, product category and attributes

The researcher used the Kano Model to better visualize the different categories found in the contracts. The researcher didn't develop an in-depth Kano Model Analysis by questionnaire, rather used the model to make an analysis of expected, normal and exciting attributes. This analysis was made by collecting data from contracts, internal documents and interviews.

3.5.2 Phase 2: Linking to the right supply chain strategy

In phase 2, the researcher used the models described by Mason-Jones et al (2000); (Christopher, 2000); Beck et al., (2012) and Hoffman et al., (2012). Adapting the attributes for choosing the right supply chain strategy for the customers, the researcher created a framework as shown in table 9. As already discussed in the theory section, different strategies can be used depending one performance metrics, demand variability, and volume order.

Table 9 The framework build to link to the right supply strategy

Product need overview			
Number of orders	High	Medium to High	Low
Demand variability	High	Medium to High	Low
Picking type			
Contract needs			
Hoffman (2012) (Mason-Jones et al (2000) Christopher (2000)	Agile	Leagile	Lean
Possible actions			

In phase 2, the researcher used statistical data to identify demand variability, orders and combined the results from phase 1. In this way, customers could be categorized into either agile, leagile or lean supply chain strategy.

3.5.3. Method discussion

As stated before, the methods applied in this thesis were designed to be suitable for collecting a large amount of data during a relatively short time. The researcher used and combined

several data collection methods for answering the research questions. Due to the confidentiality agreement, only a number of written documents were investigated. As always, reliability and validity can be an issue when conducting a project in a large company because information is global. For example, some documents were requested by e-mail from different locations and it was not possible to make face-to-face interviews. Many of the participants chosen in this study were recommended by the supervisor at the company and it could have been beneficial to interview a larger group of unknown participants. As a final comment, the researcher would like to add to the discussion of the dependability of quantitative data such as the financial data for sales and demand. As the business environment is always changing and many factors can affect today's business, the researcher thinks it is beneficial to state that the data collected was focused on this particular study. Perhaps closer analyses of the statistical data would strengthen the reliability and validity of this study. As this study was based on a single case study design, more case studies in different locations would strengthen the transferability of the findings.

4. RESULTS & ANALYSIS

The aim of this chapter is to present the findings from Phase 1 and Phase 2. It follows the same outline presented for the selected methodology. First, the researcher presents the results from phase 1 and then for phase 2. Due to confidentially agreement, the researcher will not present detailed insight of the company’s customers, suppliers, sales data or processes.

4.1 Phase 1: The reviewing of contracts

From the initial interviews, it was clear that the logistics process for a medical device company is complex and involves many actors. From the internal documents, the researcher got more understanding of the different product categories and customer segments. These documents focused on the Swedish market and in this market, the customers are public and private acute care, pharmaceutical wholesalers and medical resellers. From the interview with the Value Chain Development Director, it was stated: “Customers having different requirement, and value performance differently”. The Customer Support Director said: “We need to get a better grasp of our standard offering and understand what extra services we provide”. This approach is in line with Hofmann (2012) stating that meeting all customer requirements in one supply chain “one-size fit all approach” may no longer be profitable.

The reviewing of the contracts showed several logistics attributes and the diversity of different attributes between different customers. In overall, all of the customers required basic order management and had clearly defined packaging and logistics terms. For example, the importance of traceability and cleanliness was seen from the customers in the contracts. An example of the different attributes identified is shown in table 10.

Table 10 Results of the categorization and different factors in the contracts.

Customer →	A	B	C	D	E	F
Product category →						
Attributes ↓						
3 layer protection		•		•		
EUR pallet	•	•				•
Pallet special tag						
One time pallet		•	•	•		
EUR max 1,9m	•	•	•	•	•	
EUR 1,2m – 1,8m				•		
Max 600kg	•	•	•	•	•	
Max 800kg						
Max 20kg for single pack	•	•		•	•	
Cross-docking						
Double stack OK						
Temp tales						
At hand 3 day order delivery	•	•		•		
At hand 5 day order delivery			•		•	
At hand 4- 6 day order delivery						
Special delivery time (Eg. Cooling good before 12am)						•
Return accepted within (1 month)	•	•				
Return handled within (8days)						•

Culey (2012) describes that it is vital for businesses to understand their customer needs and how to add value to the customers. The researcher found different attributes and its values between the different customer segments. In this way, the researcher could get an overview of what was stated in the contracts. The researcher also reviewed complaint reports from customers during the year 2015 and used the data to understand the customer feedback for improvements. The data analysis was in accordance with the principle that in today's business environment many companies have outsourced logistics functions to **third-party logistics providers** (3PL) and collaboration between the company and 3PL are an integral part of delivering value to the customer and meeting their needs. (Ahl & Johansson, 2002 cited in Atkacuna & Furlan, 2009). Therefore many of the complaints can be seen as an opportunity for improvement between the company and 3PL. The reviews of contracts showed that different customer has different requirements on the logistics service. All customers have some basic requirements in order management and packaging, these are essential for product traceability and product safety. These two dimensions can be seen as important from the healthcare supply chain that focuses on patient safety (Smith et al. 2011). The contracts also showed different terms regarding order responsiveness, labeling, and distribution. Beck et al. (2012) describe the necessity to serve customers according to their requirements and needs. At the same time, an organization need to adapt the right supply chain strategy according to market and product attributes (Christopher and Towill, 2002). The contract also showed penalty agreements, e.g. for late deliveries and damage during transportation. The agreed penalty agreements emphasize the need to deliver the right product at the right time to the customers. This adds to the already complicated management of supply chains with the aim to deliver different products to different customers. This shows the difficulty of a single supply chain in order to satisfy all customer requirements as they vary across various marketplaces (Hofmann, 2012)

The key findings from phase 1 are:

1. The identification of different logistics terms in the contracts and its values
2. How the identified values differs between the customers

The researcher wanted to put the identified logistic terms in relation to how customer evaluate and perceive these attributes. By using the Kano Model and comparing the collected data with studies focusing on healthcare supply chain a model was created. Table 11 below shows the three different categories in the model.

<ul style="list-style-type: none"> • Expected: <ul style="list-style-type: none"> ○ Order management (phone) ○ Delivery quality (not damaged) ○ Basic level of traceability (document) ○ Return handling (1-month) • Normal <ul style="list-style-type: none"> ○ Order management (IT) ○ Order responsiveness (24h) ○ Traceability (IT) ○ Return handling (<1month) • Exciting <ul style="list-style-type: none"> ○ Special delivery time ○ Quick return handling ○ Special labeling and handling ○ Design for transportation ○ Traceability (IT) Whole operation 	
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Table 11. Three different categories of quality attribute

Huiskonen & Pirttilä (1996) describes the expected element as unnoticed by customers but it is needed to recognize them and their minimum acceptable level of expected services. If a company under exceeding the level, the customer will be dissatisfied. On the other hand, if the company has higher service level it will increase cost without adding to customer value.

As the healthcare supply chain is changing and adopting digital technology to improve traceability and minimize process variation the normal attributes will lead to satisfaction when fulfilled. These attributes are seen to be those the companies will be competing with and is in line with the theory of the model presented by (Gustafsson 1998 cited in Lovgren & Witell 2005). Huiskonen & Pirttilä (1996) mention that customer reaction will depend on the level of service offered. The better the company offer a service the more satisfied will the customer be.

The exciting attributes will delight the customers and the Kano Model suggests that these will become must-be attributes in the future (Lofgren 2005). Huiskonen & Pirttilä (1996) describe that attractive or exciting attributes can overpass the customer expectation but their absence will not create dissatisfaction. The reason for the latter is because customers are not used to getting them. Further on, looking at supply chain trends in healthcare these attributes can be used to differentiate the service offering from competitors (Huiskonen & Pirttilä, 1996)

4.2 Phase 2: Linking to the right Supply Chain Strategy

As Christopher (2001) describes, lean supply chain strategy works best in high volume, low variety, and predictable environments. While agility focuses on flexibility, lean focuses on minimizing waste. Combining data and the results identified in phase 1, some customers valued quality and cost compared with quality and lead time. Agility strategy is a way to meet

volatile service demand and provides high availability (Christopher and Towill, 2001). The researcher completed the framework presented in the method chapter. For one segment the customer's required high availability and their demand variability was higher compared with the other segments. With the identified logistics attributes in the contracts, the researcher now focused on understanding the financial data for serving these customers. The first step was to examine the number of orders and the number of deliveries for the Swedish market. The data available was for the second quarter (Q2) in 2016. The researcher identified different customer clusters and mapped the difference between customers and compared their sales for Q2. This is shown in figure 21.

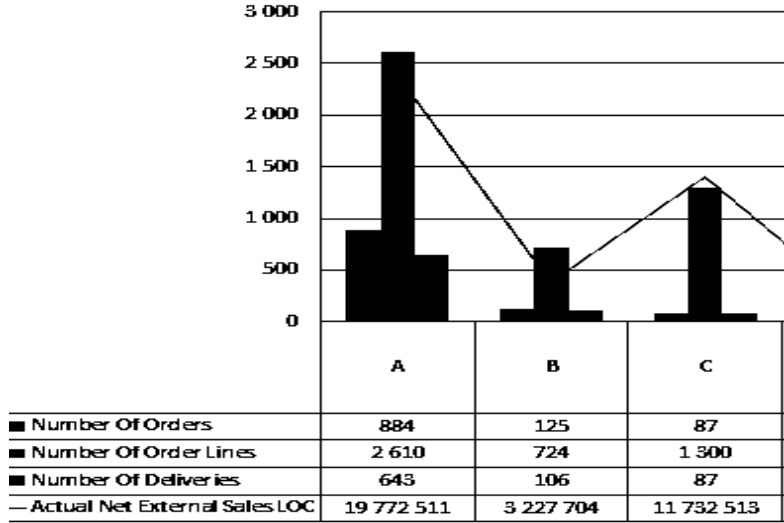


Figure 21 Data analysis between different customers

In figure 21 it can be seen that customer A have more orders and deliveries than customer C.. The researcher then created a case focusing on customers in the following segments: Hospital distributors, wholesalers, and pharmacy. In total two customers in each segment was analyzed. An example of analysis between three customers from different segments is shown in figure 22.



Figure 22 Data analysis between three customers

Another cluster analysis was created based on volume (CBM) and gross contribution as shown in figure 23. Here it is seen that customers have different order volume and contribute differently to profitability.

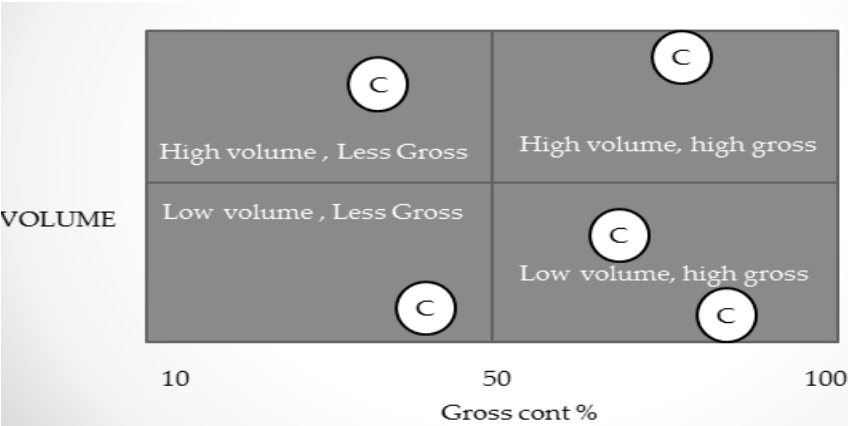


Figure 23 Cluster matrix for comparing volume and gross contribution between customers

With the data available, the researcher could see that some customers had higher orders and their demand variability was higher. These customers tend also to have high product variety which is characteristics to agile supply strategy. A third supply strategy is combining both lean and agile strategy by strategically positioning the de-coupling point and uses the best of both worlds (Christopher and Towill, 2001). Based on the reviewed contracts, one customer segment was seen to not have any attributes that matched as either lean or agile. Instead, they seemed to prefer both short lead-times combined with quality at low cost. This group was identified to best suit under leagile supply strategy.

Table 12 The result of framework for choosing the right supply strategy

Customer segment	A	B	C
Product need overview			
Product volume	High	Medium to High	Low
Product variety	High	Medium to High	Low
Demand variability	High	Medium to High	Low
Picking type	TRP RET Pallet	TRP Pallet	TRP
Contract needs	<ul style="list-style-type: none"> Order responsiveness Delivery reliability Cost 	<ul style="list-style-type: none"> Flexibility regarding lead time and product variety Lead time 	<ul style="list-style-type: none"> Delivery reliability Servicelevel
Hoffman (2012) (Mason-Jones et al (2000) Christopher (2000)	Agile "volatile demand"	Leagile "hybrid"	Lean "predictable"

For customer segment A, the picking type is varying and being flexible to meet these needs is in line with agile strategy, see table 12 above. The most cost-efficient picking type is full

pallet while retail packaging (RET) is the most expensive. These customers use a mix of packaging types and require delivery reliability and fast order responsiveness. As Naylor et al (1999) defines, the agility means responding quickly to changes in the information from the market. For customer segment C, the orders and demand variability were less volatile than customer segment B. The customer in segment B sees flexibility and the possibility of ordering different products as an important factor and based on the model from (Hoffman (2012), their profile fits the Leagile strategy. This strategy strives to drive down cost upstream while ensuring agile response to respond to an unpredictable marketplace downstream (Mason-Jones et al. 2000).

5. CONCLUSIONS AND RECOMMENDATIONS

This chapter aims to present the conclusion from Phase 1 and Phase 2. Further, the purpose of this chapter is to give recommendations how the organization should strive forward to continue to delight their customers and improve their supply chain. Finally, the researcher will also present ideas for future research.

5.1 Conclusions

Supply Chain Differentiation starts with the customer, understanding the structure, behavior, and strategies of what the customer sees as value (Culey, 2012). The first research question was regarding what logistics service elements and its values were stated in various contracts. The researcher reviewed contracts and internal documents in phase 1. Phase 1 revealed different logistics terms in the contracts and its values. Also, it was shown how the different values differed between the different customer segments. The conclusion is that today the customers require a menu of different logistics needs and requirements. Also, they differ between the customer segments. This increases complexity and all the customer logistics needs and requirements cannot be met in one-size fit all supply chain.

The second research question was regarding if there was data to support differentiated supply strategy. Data collected from phase 2 added to the differences between customers in terms of the amount of order, demand variability, and product varieties. These findings showed the need to match the right supply chain strategy for different customers in order satisfy all customers and be more efficient. Matching the theoretical models presented for different supply strategy, the customers were classified into the supply strategies. The analysis from phase 1 and phase 2 showed a possible way on how to use different supply strategies. It is also a way to improve the supply chain and meet future customer needs. The conclusion is that it exist a need to match the right supply strategy to different customer segments making sure to fully satisfy customers and improve the supply chain.

5.2 Recommendations

The recommendations for the company are, therefore:

- 1. Offer a standard menu of logistics service**
 - This would align marketing, manufacturing and supply chain on strategic, tactical and operational level
 - Offer customers to choose from additional logistics services as add-ons or premium agreement
- 2. Continue to improve the supply chain together with logistics provider, partners, and customers**
 - Eliminate waste in the supply chain (E.g. improvement projects for eliminating picking errors, late deliveries, and packaging damage)
- 3. Match the right supply strategy to different customer segments**

- By matching the right supply strategy the company can increase customer service satisfaction level, eliminate non-value adding steps and assure higher delivery reliability.
- This step would meet future supply chain trends and add to the mission of ensuring patient safety and providing outstanding solutions for patients

5.3 Future research

This thesis was made site-specific at the company's office in Gothenburg and didn't cover the reviewing of contracts and data from other locations. It can be interesting for the company to compare this study with another geographical area to find common patterns. Another interesting area is for the academic to study in detail the different supply chain strategies in the medical device industry. Any contribution to give more insight into these strategies is beneficial for supply chain practitioners. This would benefit both the industry and public sector and contribute to the mission of better care for patients in terms of increased safety and reduced costs.

6. BIBLIOGRAPHY

Aitken, J., Childerhouse, P., Christopher, M., Towill, D. (2005). "Designing and managing multiple pipelines". *Journal of Business Logistics*, vol. 26, no. 2, pp. 73-95

Aitken, J., Childerhouse, P., Towill, D. (2003). "The impact of product life cycle on supply chain strategy". *International Journal of Production Economics*, vol. 85, pp. 127-140.

Aliaga, Martha & Gunderson, Brenda. (2005). *Interactive Statistics*. 3rd ed. Great Britain: Pearson. 1088.

Anderson, John. (2006). *Qualitative and Quantitative research*. Available: http://www.icoe.org/webfm_send/1936. Last accessed 27th May 2014.

Arvidsson, L (2007) *Vårdlogistik – rätt patient får rätt vård av rätt kvalitet, på rätt nivå, på rätt plats, vid rätt tidpunkt, till rätt kostnad*. Available: <http://webbutik.skl.se/sv/artiklar/varldlogistik-ratt-patient-far-ratt-var-d-av-ratt-kvalitet-pa-ratt-niva-pa-ratt-plats-vid-ratt-tidpunk.html>. Last accessed 21th November 2016

Atkacuna, Ilze & Furlan, Karolina (2009). *Value-Added Services in Third-Party Logistics*. Available <http://hj.diva-portal.org/smash/get/diva2:233689/FULLTEXT01.pdf> Last accessed 30th November 2016 M.sc Jönköping Business School

Baxter. P & Jack. S (2008) Available: <http://nsuworks.nova.edu/tqr/vol13/iss4/2/>. Last accessed 21th November 2016

Becks, R. (2012). "Supply Chain Segmentation 2.0". E2open, August 17. Webpage: http://info.e2open.com/rs/e2open/images/White%2520Paper_SC%2520Segmentation%2520Part%2520II.pdf?mkt_tok=3RkMMJWWfF9wsRonva/BZKXonjHpfsX56eUtW6C3IMI/0ER3fOvrPUfGjI4HScF0dvycMRAVFZI5nQkKfFCQcg%3D%3D. Retrieved: 2016-10-15.

Bender, Alexander (2014) Available: http://www.supplychain247.com/paper/supply_chain_segmentation_strategies_to_manage_complexity/OPS_Rules_Management_Consultants. Last accessed 21th November 2016

Bergman, B. & Klefsjö, B. 2010, *Quality from Customer needs to customer satisfaction, 3rd edition*, Studentlitteratur, Lund

Burney. A (2008) Available: <http://www.drburney.net/INDUCTIVE%20&%20DEDUCTIVE%20RESEARCH%20APPROACH%2006032008.pdf>. Last accessed 21th November 2016

Childerhouse, P., Aitken, J., Towill, D. (2002). "Analysis and design of focused demand chains". *Journal of Operations Management*, vol. 20, pp. 675-689

Christopher, M., Towill, D. (2000). "Marrying lean and agile paradigms". *Proceedings of the EUROMA 2000 Conference, Ghent*, pp. 114-121.

Christopher, M., Towill, D. (2001). "An integrated model for the design of agile supply chains". *International Journal of Physical Distribution and Logistics Management*, vol. 31, no 4, pp. 235-246.

Christopher, M., Towill, D. (2002). "Developing Market Specific Supply Chain Strategies". *International Journal of Logistics Management*. vol. 13, no. 1, pp. 1-14.

Cohen, Louis (2011). *Research Methods in Education* . 7th ed. London: Routledge. 784.

Creswell, John W & Miller, Dana L. (2010). *Determining Validity in Qualitative Inquiry. Getting Good Qualitative Data to Improve Educational Practice*. 39 (3), 124-130.

Creswell, John W (2014). *Research design : qualitative, quantitative, and mixed methods approaches* . 4th ed. Los Angeles: Sage Publication Ltd. 273

Culey, Sean (2012). Available: <http://www.europeanbusinessreview.com/segmenting-for-success-from-value-chain-theory-to-everyday-execution/>. Retrieved: 2016-09-13.

Dubois, A. & Gadde, L-E., (2002) *Systematic combining: an abductive approach to case research*. *Journal of Business Research* Volume 55 Issue 7

EY (2012). "Supply Chain Segmentation". Available: http://performance.ey.com/wp-content/uploads/downloads/2013/02/Supply-chain-segmentation_DC0121.pdf. Retrieved: 2013-09-13.

Godsell, J. (2008). *Developing Customer Responsive Supply Chain Strategy: An Empirical Investigation of the Relationship between Market Segmentation and Supply Chain Strategy*. PhD thesis, Cranfield University, Cranfield.

Godsell, J., Diefenbach, T., Clemmow, C., Towill, D., Christopher, M. (2011). "Enabling supply chain segmentation through demand profiling" *International Journal of Physical Distribution & Logistics Management*, vol. 41, no. 3, pp. 296-314.

Hilletofth, P., JTH. *Forskningsmiljö Industriell produktion, Högskolan i Jönköping & Tekniska Högskolan 2012*, "Differentiation focused supply chain design", *Industrial Management & Data Systems*, vol. 112, no. 9, pp. 1274 1291

Hoekstra, S., Romme, J. (1992). *Integral Logistics Structures: Developing Customer-oriented Goods Flow*, Industrial Press, New York.

Hofmann, E., Beck, P., Füger, E. & SpringerLink (ebook collection) 2012;2013;, *The supply chain differentiation guide: a roadmap to operational excellence*, 1. Aufl. edn, Springer, New York;Heidelberg;.

Holmqvist, Anna., Norkjaer, Michael., Ullmark, Björn (2009). *The Art of Turning Relationships into Competitive Advantages: Managing direct customer relationships in China*. Msc. Kalmar University.

Höst, Martin., Regnell, Björn., Runeson,Per. (2006). *Att genomföra examensarbete* . 2nd ed. Lund: Studentlitterature. 153

Huan, S.H., Sheoran, S.K. & Wang, G. 2004, "A review and analysis of supply chain operations reference (SCOR) model", *Supply Chain Management: An International Journal*, vol. 9, no. 1, pp. 23-29

Huiskonen, J. & Pirttilä, T. 1998, "Sharpening logistics customer service strategy planning by applying Kano's quality element classification", *International Journal of Production Economics*, vol. 56, no. 1, pp. 253-260.

Jeston, J. & Nelis, J. 2006, *Business process management: practical guidelines to successful implementations*, 1st edn, Butterworth-Heinemann, Burlington, MA

Joshi, N., Jain, A., Sharma, A., Mahapatra, S. (2014) Available: http://www.tcs.com/resources/white_papers/Pages/Cost-to-Serve-Analysis.aspx. Last accessed 21st November 2016

Johansson, R. (2003) Available: http://psyking.net/htmlobj-3839/case_study_methodology-_rolf_johansson_ver_2.pdf Last accessed 21st November 2016

Kong and Allan (2007). Explaining push and pull models. Available: http://kongandallan.com/en/us_pdf/EPPS0711U.pdf. Last accessed 21st November 2016

Kwon, I.G., Kim, S. & Martin, D.G. 2016, "Healthcare supply chain management; strategic areas for quality and financial improvement", *Technological Forecasting and Social Change*

Mack, Natasha., Woodsong, Cynthia., Macqueen, Kathleen., Guset, Greg., Namey, Emily (2005). *Qualitative Research Methods: A Data Collector's Field Guide*. North Carolina: Family Health International. 120.

Mason-Jones, R., Naylor, B., Towill, D. (2000). "Lean, agile or leagile? Matching your supply chain to the marketplace". *International Journal of Production Research*, vol. 38, no. 17, pp. 4061-4070.

Menyah, Dave. (2010). Overview of Case Study Models and Methodology. Available: http://www.capam.org/_documents/reportoncasestudymethodologies.pdf. Last accessed 29th September 2016

Mustafa Danar (2014). *Project Risk Management: An initiative towards opportunity management*. Bsc. Chalmers University of Technology.

Näslund, D & Williamson, S. (2006). *Segmenting for Success – From Value Chain Theory to Everyday Execution*. Available: <http://m.www.na-businesspress.com/JMPP/NaslundWeb.pdf>. Last accessed 21st November 2016

Näslund, D., Williamson, S. (2010). "What is Management in Supply Chain Management? – A Critical Review of Definitions, Frameworks and Terminology". *Journal of Management Policy and Practice*, vol. 11, no. 4, pp. 11-24.

- Naylor, B., Naim, M., Berry, D. (1999). "Leagility: Integrating the lean and agile manufacturing paradigms in the total supply chain". *International Journal of Production Economics*, vol. 62, pp. 107-118.
- Project Management Institute (2000). *A Guide to the Project Management Body of Knowledge*. 2nd ed. Newton Square, United States of America: Project Management Institute Inc.. 216.
- Rose, S, Nigel.S, Ana Isabel. C (2015) Available: <https://www.routledge.com/Management-Research-Appling-the-Principles/Rose-Spinks-Canhoto/p/book/9780415628129> Last accessed 21th November 2016
- Sean, Culey. (2006). *Segmenting for Success – From Value Chain Theory to Everyday Execution*. Available: <http://www.europeanbusinessreview.com/segmenting-for-success-from-value-chain-theory-to-everyday-execution/>. Last accessed 21th November 2016
- Smith, B.K., Nachtmann, H. & Pohl, E.A. 2011, "Quality Measurement in the Healthcare Supply Chain", *The Quality Management Journal*, vol. 18, no. 4, pp. 50
- Stock, J., Boyer, S. (2009). "Developing a consensus definition of supply chain management: a qualitative study". *International Journal of Physical Distribution and Logistics Management*, vol. 39, no. 8, pp. 690-711.
- Supply Chain Council (2008). *SCOR Overview*, version 8.0.
- Svennevig, Jan. (2003). *Abduction as a methodological approach to the study of spoken interaction*. Available: <http://home.bi.no/a0210593/Abduction%20as%20a%20methodological%20.pdf>. Last accessed 28th September 2016.
- Zhang, H. & Zhao, G. 2008, "Strategic Selection of Push-Pull Supply Chain", *Modern Applied Science*, vol. 2, no. 1.

7. APPENDIX
